

The Low Temperature Microgravity Physics Experiments Project

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The Low Temperature Microgravity Physics Facility (LTMPF) is being developed by NASA to provide long duration low temperature and microgravity environment on the International Space Station (ISS) for performing fundamental physics investigations. Currently, six experiments have been selected for flight definition studies. More will be selected in a two-year cycle, through NASA Research Announcement. This program is managed under the Low Temperature Microgravity Physics Experiments Project Office at the Jet Propulsion Laboratory. The facility is being designed to launch and returned to earth on a variety of vehicles including the HII-A and the space shuttle. On orbit, the facility will be connected to the Exposed Facility on the Japanese Experiment Module, Kibo. Features of the facility include a cryostat capable of maintaining superfluid helium at a temperature of 1.4 K for 5 months, resistance thermometer bridges, multi-stage thermal isolation system , thermometers capable of pico-Kelvin resolution, DC SQUID magnetometers, passive vibration isolation, and magnetic shields with a shielding factor of 80dB. The electronics and software architecture incorporates two VME buses run using the VxWorks operating system. Technically challenging areas in the design effort include the following:

- 1) A long cryogen life that survives several launch and test cycles without the need to replace support straps for the helium tank.
- 2) The minimization of heat generation in the sample stage caused by launch vibration
- 3) The design of compact and lightweight DC SQUID electronics.
- 4) The minimization of RF interference for the measurement of heat at pico-Watt level.
- 5) Light weighting of the magnetic shields.
- 6) Implementation of a modular and flexible electronics and software architecture.

The first launch is scheduled for mid-2003, on an H-IIA Rocket Transfer Vehicle, out of the Tanegashima Space Center of Japan. Two identical facilities will be built. While one facility is onboard the ISS, the other is re-integrated on the ground with new experiments. When the cryogen of the facility in space are exhausted, it will be swapped with the other facility with the new experiment. A total of 20 science missions are envisioned over the next 20 years.